

WHAT IS CLAIMED IS:

- 1 1. An apparatus for forming at least one ring with an undercut or
2 overhang on a lead battery terminal, the apparatus comprising:
3 a fixture configured to securely position the battery terminal;
4 a rolling station including a cold metal forming member
5 configured to transform at least one ring on the battery terminal from having
6 a first shape into a second different shape with an undercut or overhang
7 when the battery terminal and cold metal forming member are rotated relative
8 to each other; and
9 a drive assembly configured to rotate the battery terminal and
10 cold metal forming member relative to each other.
- 1 2. The apparatus of Claim 1, wherein the first shape of the at least
2 one ring is a rectangle in cross-section.
- 1 3. The apparatus of Claim 1, wherein the second shape of the at
2 least one ring is an arrowhead in cross-section.
- 1 4. The apparatus of Claim 1, wherein the at least one ring is a pair
2 of rings.
- 1 5. The apparatus of Claim 1, wherein the cold metal forming
2 member includes at least one roller.
- 1 6. The apparatus of Claim 5, wherein the at least roller is a cam
2 including an outer circumference having a burnishing portion.
- 1 7. The apparatus of Claim 5, wherein the at least roller is a cam
2 including an outer circumference having a shaping portion with at least one
3 valley including a pair of sidewalls set at an angle of between about 90° to
4 about 120° relative to each other.

1 8. The apparatus of Claim 5, wherein the at least one roller
2 comprises a plurality of rollers spaced equally about an outer surface of the
3 battery terminal.

1 9. The apparatus of Claim 8, wherein each of the plurality of rollers
2 includes an outer circumference having a straight portion.

1 10. A method for forming at least one ring with an undercut or
2 overhang on a lead battery terminal, the method comprising:
3 securing the battery terminal within a fixture; and
4 engaging a cold metal forming member with an outer surface of
5 the lead battery terminal while the cold metal forming member and the
6 battery terminal are rotating relative to each other;
7 transforming at least one ring on the lead battery terminal from
8 having a first shape into a second different shape with an undercut or
9 overhang.

1 11. The method of Claim 10, wherein the engaging step includes
2 contacting the outer surface of the battery terminal with at least one roller.

3 12. The method of Claim 11, wherein the engaging step includes
4 contacting the outer surface of the battery terminal with a plurality of rollers
5 positioned at equally spaced locations around the outer surface of the battery
6 terminal.

1 13. The method of Claim 12, wherein the plurality of rollers are
2 configured to revolve about the battery terminal at a first rate of speed while
3 each roller is configured to rotate about its own axis at a second rate of
4 speed.

1 14. The method of Claim 13, wherein the transformation step is
2 accomplished by a single rotation of each of the plurality of rollers about its
3 own axis.

1 15. The method of Claim 13, wherein the first speed is higher than
2 the second rate of speed.

1 16. The method of Claim 15, wherein the first rate of speed is
2 between about 500 to about 600 RPM while the second rate of speed is
3 between about 20 to about 30 RPM.

1 17. The method of Claim 10, wherein the transforming step is
2 accomplished without substantially removing any material from the at least
3 one ring.

1 18. The method of Claim 10, further including the step of cold
2 pressing the battery terminal from a lead slug into a semi-finished shape
3 including the annular rings having the first cross-sectional shape prior to the
4 engaging step.

1 19. The method of Claim 10, wherein the first cross-sectional shape
2 is a rectangle.

1 20. A method for forming a finished lead alloy battery terminal with
2 at least one sealing ring having an undercut or overhang, the method
3 comprising:

4 securing a partial-finished battery terminal within a fixture, the
5 partial-finished battery terminal including at least one sealing ring lacking an
6 undercut or overhang; and

7 engaging a cold metal forming member with the at least one
8 sealing ring of the partial-finished battery terminal while the cold metal
9 forming member and the partial-finished battery terminal are rotating relative
10 to each other; and

11 reshaping the at least one sealing ring on the partial-finished
12 battery terminal into a sealing ring on the finished battery terminal having an
13 undercut or overhang without substantially removing any material.

1 21. The method of Claim 20, wherein the reshaping step comprises
2 radial rolling corners of the at least one sealing ring on the partial-finished
3 battery terminal to push the lead alloy material outward and backward
4 towards a base diameter surface of the battery terminal.

1 22. The method of Claim 21, wherein the radial rolling step produces
2 a pair of undercuts on the at least one sealing ring with each undercut having
3 a radius of curvature between about 0.10 and about 0.30 inches.